REPORT

INDUSTRIAL TOWEL LAUNDRY FACILITY EMISSIONS TEST

Test Site

G&K Services, Inc.
324 Taylor Street
Manchester, NH 03103

Prepared for

G&K Services, Inc.
Minnetonka, MN

Prepared by

TRC
Windsor, CT

January 2013

REPORT

INDUSTRIAL TOWEL LAUNDRY FACILITY EMISSIONS TEST

Test Site
G&K Services, Inc.
324 Taylor Street
Manchester, NH 03103

Prepared for
G&K Services, Inc.
Minnetonka, MN

Prepared by
TRC
Windsor, CT

Raymond Potter

TRC Project No. 193461.0000.0000
January 2013

TRC
21 Griffin Road North
Windsor, CT 06095
Telephone 860-298-9692
Facsimile 860-298-6399

INDUSTRIAL TOWEL LAUNDRY FACILITY EMISSIONS TEST

Report Certification

I certify that to the best of my knowledge:

- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and applicable reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).

TRC Project Manager

January 9, 2013
Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.

Jeffrey W. Burdette
TRC Air Measurements Technical Director

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

TRC Environmental Corporation of Windsor, Connecticut ("TRC") was retained by G&K Services, Inc. ("G&K") to perform emissions testing at the G&K industrial towel laundering facility located at 324 and 341 Taylor Street in Manchester, New Hampshire (collectively, the "Facility"). G&K conducted the emission testing in accordance with Appendix A, Paragraph 6 of Consent Decree 11-cv-342-SM with the U.S. Environmental Protection Agency ("EPA"). This report is intended to satisfy Paragraph 7 of the Consent Decree.

1.1 Test Program Summary

The Facility receives two types of towels which may contain volatile organic compounds ("VOCs") and organic hazardous air pollutants ("HAPs"): shop towels and print towels. The test objective was to develop separate emission factors for shop towels and print towels. The towels are received in plastic bags, washed with detergent and hot water in two 900 pound (clean dry weight) Ellis stripper/washer/condenser systems, and then dried in a natural gas-fired dryer. Steam and hot water for the washers is generated with a natural gas fired by a Clayton Industries steam generator and wastewater from the two washers is treated on site by a dissolved air flotation ("DAF") wastewater pretreatment system.

Facility-wide VOCs and HAPs are potentially emitted at the Towel Wash Room from the following sources: the two Ellis system stacks, dryer exhaust stack; as area source emissions from the "Towel Wash Room" where receiving, sorting, weighing, washing, drying, and wastewater treatment operations are conducted; and two wastewater treatment equalization tanks (EQ Tanks). The EQ Tanks are a de minimis VOC emissions source and were ducted into the Towel Wash Room. The steam generator is located outside the Towel Wash Room and was not tested. The hot water heater that was in place for the 2009 testing has been shutdown and its air intake was covered. Tests were also conducted on a temporary room exhaust system installed on the Towel Wash Room for the purpose of the testing.

The test strategy was to conduct emission tests on three days. Two test days, November 27 and 28, were dedicated to the washing of shop towels (one day of testing with the Ellis washers conducting stripping and one day with the Ellis washers bypassing the strip cycle) and one day of testing was dedicated to the washing of print towels. Emissions from reconditioning of print towels were tested on November 29. Tests were conducted during a sufficient number of wash loads to develop representative data. The Facility processed six wash loads during each of the shop towel test days. The Facility attempted to process four wash loads during the print towel test day, but during the fourth washer load the facility steam generator tripped when the blower motor failed and could not be repaired.

Daily actual VOC emissions were determined for each test day by calculating the sum of: (1) area source emissions from the Towel Wash Room; (2) Ellis Washer systems emissions; and (3) towel drying emissions. Ultimately, emission factors were determined for each towel type on the basis of pounds of emissions per pound of soiled towel weight (lb/lb-soiled weight).

The test included several methods and temporary exhaust systems installed on the Towel Wash Room and on the Ellis Washer System vents. The Towel Wash Room was operated as a permanent enclosure in accordance with EPA Method 204 criteria. Total VOC emission concentrations were measured continuously in accordance with EPA Method 25A over the entire duration of the test from all 4 emission points. Individual HAP emissions were measured periodically in accordance with EPA Method TO-15.

1.2 Test Program Organization

Table 1-1 presents the applicable contact information.

Table 1-1 Contact Information

G&K Services-Environmental Engineer	Mr. Brian Duffy	(952) 912-5713
G&K Services-Site Contact	Mr. Bob Hippert	(603) 625-9722
EPA Region I-Environmental Engineer	Mr. Bill Osbahr	(613) 918-8389
EPA Region I-Environmental Engineer	Ms. Beth Kudarauskas	(617) 918-1564
NH DES – Testing and Monitoring Supervisor	Mr. Mike O'Brien	(603) 271-1089
NH DES – Senior Enforcement Engineer	Mr. Craig Nowell	(603) 271-0885
TRC Project Manager	Mr. Jim Canora	(860) 298-6304 (860) 559-3650 (mobile)
TRC Field Team Leader and Test Coordinator	Mr. Ray Potter	(860) 298-6337 (860) 214-0867 (mobile)
TRC QA/QC Officer	Mr. Edward MacKinnon	(978) 656-3553

2.0 SOURCE DESCRIPTION

2.1 Process Description

G&K operates an industrial laundry at 341 Taylor Street. The building includes 10,350 square feet of total floor space. There are two separate buildings, one for clean product storage and steam generation and the other for all Towel Wash Room operations. The two buildings are connected by a large open doorway. The Towel Wash Room building contains the receiving and sorting area, two Ellis stripper/washer/condensers, one gas-fired dryer, and the wastewater treatment equipment. In addition, there are two 22,000-gallon equalization tanks associated with wastewater treatment that are located outside of the building. A floor plan drawing showing equipment locations is presented in Appendix A.

The complete production cycle for print towels and non-bulk shop towels is described below and is depicted in the flow diagram in Figure 2-1.

1. For the purpose of this test, the print towels and non-bulk shop towels were picked-up at the customer's location and delivered to the Facility as follows:

   Print Towels: Print towels were picked up at the customer's location in sealed plastic bags or covered plastic containers. The soiled product was placed into a plastic bag or plastic container and a soil ticket was placed inside each bag/container. The soil ticket identifies the customer and the product inside the bag/container. The G&K driver attached chain of custody tape to the neck of the bag or the container lid to prevent tampering. Time, date and driver signature were marked on the tape. The bags and plastic containers were stored either in a trailer or in sealed totes at the Facility prior to laundering.

   Non-Bulk Shop Towels from Local Routes: Non-bulk shop towels from local routes were received from customers in plastic bags or metal cage containers. The soiled product was placed into a plastic bag or metal cage container and a soil ticket was placed inside each bag/container. The soil ticket identifies the customer and the product inside the bag/container. The G&K driver attached chain of custody tape to the neck of the bag or the container to prevent tampering. Time, date and driver signature were marked on the tape. These towels were immediately placed in sealed, non-perforated plastic bags upon receipt at the Facility and were taped and labeled with the date, time, and signature. The sealed bags were then stored either in a trailer or in sealed totes prior to laundering.

   Non-Bulk Shop Towels from Out-of-Town Routes: Non-bulk shop towels from out-of-town routes were received from customers in plastic bags or metal cage containers. The soiled product was placed into a plastic bag or metal cage container and a soil ticket was placed inside each bag/container. The soil ticket identifies the customer and the product inside the bag/container. The G&K driver attached chain of custody tape to the neck of the bag or the container lid to prevent tampering. Time, date and driver signature were marked on the tape. The towels were delivered to a G&K branch office. The sealed bags were transferred to the Facility and stored in either a trailer or in sealed totes prior to laundering.

2. The sealed, non-perforated plastic bags and covered plastic containers were moved to the SorTech Counting System. Each bag/container was opened and the contents were placed onto the SorTech table. The soil ticket was removed and placed onto a clip board.

3. The SorTech Operator selected the "Shop Towel" or "Print Towel" function. The operator was prompted to place a sample of 10 items on the small scale. This sample was used to determine the average soil weight of each towel. When prompted, the SorTech Operator placed the entire contents of the bag/container into a sling and 4-post cart which sits on the large floor scale. The system uses the average weight of each towel to determine the number of towels contained in the bag/container.

4. The SorTech Operator recorded the piece count contained in each bag/container on the soil ticket.

5. The SorTech Operator continued counting product until the sling was full. Once the sling was filled to the proper weight, the SorTech Operator filled out a weight ticket for each sling. Two slings of soiled towels served each of the four pockets in the Ellis stripper/washer/condenser system. The total soiled weight of a soiled shop towel load was 1200 lb and of a soiled print towel load was 900 lb, so the respective pocket weights were 300 lb and 225 lb.

6. The slings were lifted in the air via the hoist and loaded onto the monorail system.

7. Once a washer became available, eight slings of each product (shop or print towels) were loaded into a washer. The total soiled weight of shop towels was 1200 lb and of print towels was 900 lb.

8. The wash floor operator recorded the following items on the washer log:

   - Product description (Shop Towel or Print Towel)
   - Formula selected
   - Total weight of all slings to the nearest pound
   - Start time
   - Stop time

9. The operator repeated the process of counting product with SorTech until all products were counted, loaded in slings and washed.

10. Once all soil tickets were completed they were given to the office. The number of pieces counted from each bag was entered into IMPAC and the customer will receive that volume of pieces on their next delivery.

11. The load cleaning times were:

    - Shop towels without a strip cycle (Test Day 1): between 83 and 94 minutes for the entire wash cycle
    - Shop towels with a strip cycle (Test Day 2): between 117 and 127 minutes for the entire strip and wash cycle, including 30 minutes for the strip cycle
    - Print towels (Test Day 3): between 192 and 227 minutes for the entire strip and wash cycle, including strip cycle time ranging from 86 to 120 minutes

12. Once the entire wash cycle was completed, the towels were loaded into the back of the dryer.

13. The dryer times were 30-40 minutes for both shop towels and print towels. The Ellis system is approximately twice the size of the dryer, so half of the Ellis system load is dried at a time. The overall dryer time for each wash load was 66 to 78 minutes.

14. When the product is dried, it was unloaded into carts or into clean slings and moved to the shop towel bagging machine. The towels were bagged in the following counts:

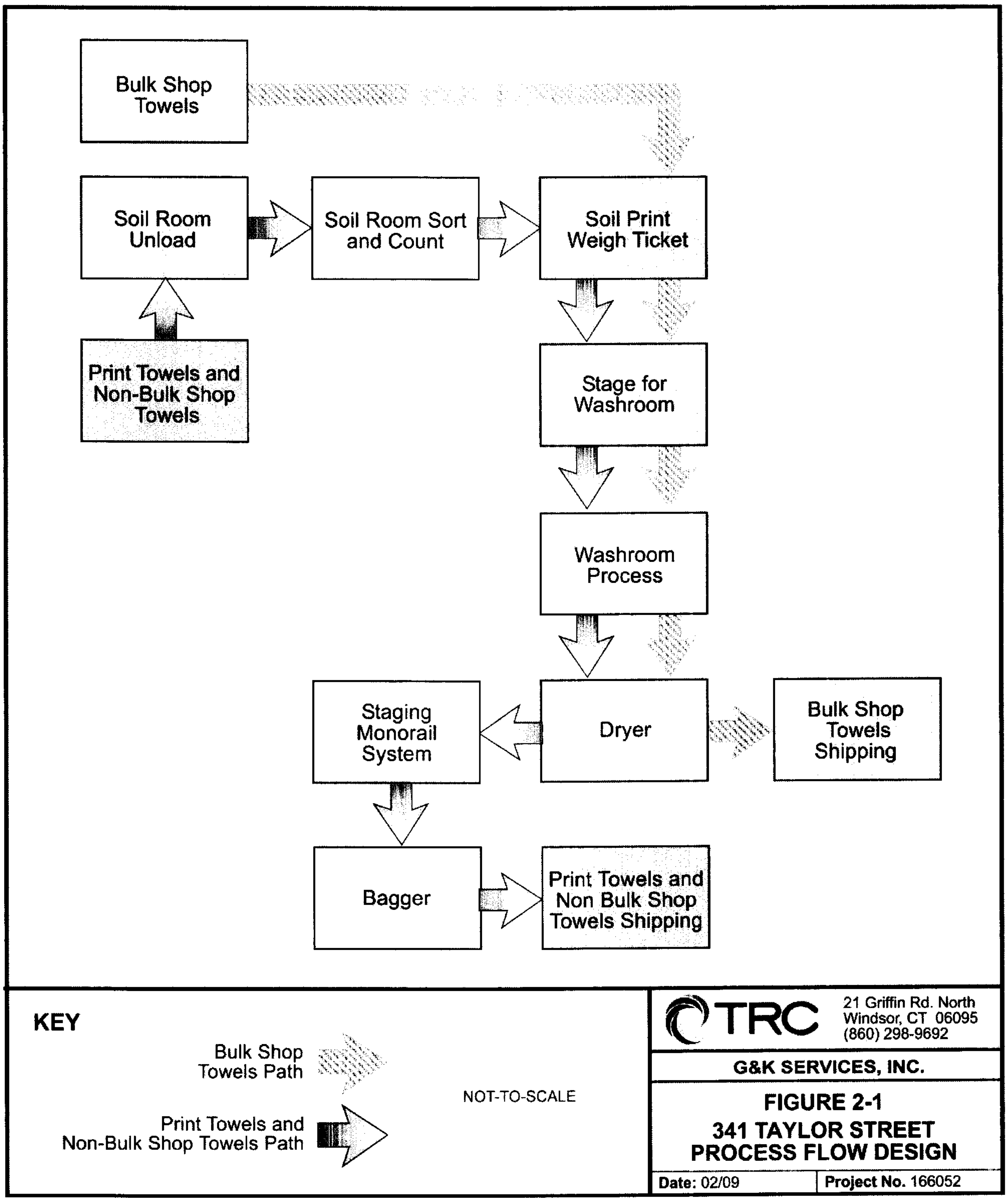
    - 18x18 shop towels 50 towels per bag
    - 18x30 print towels 25 towels per bag

The complete production cycle for bulk shop towels differs slightly from the cycle listed immediately above for print towels and non-bulk shop towels. Bulk shop towels are received from customers in sealed, non-perforated plastic bags or carts. The carts are covered and sealed at the customers' facilities prior to being loaded onto G&K trucks. The covers for the carts are plastic bags that are shrink-wrapped with poly wrap. For the purpose of this test, the plastic bags and carts were taped and labeled at the customers' facilities with the date, time, and driver signature. The towels were delivered to the branch offices and then transported to the Facility, where they were stored in either in a trailer or in sealed totes prior to laundering. The SorTech Operator placed the bulk shop towels directly into slings to the appropriate weight. The SorTech Operator then filled out a soiled weight ticket and staged it for washing as stated above. The bulk shop towels underwent the same washing and drying process. The dried bulk shop towels were returned to their shipping containers and sent back to their location of origin.

2.2 Control Equipment Description

The Ellis system is equipment with a condenser that recovers solvent from the print towels during the strip cycle. This solvent would otherwise be emitted directly to the atmosphere during the wash or drying cycles or indirectly at the wastewater treatment. The shop towels do not contain sufficient amount of solvent for the condenser to be effective, and no solvent was recovered from stripping shop towels as measured at the solvent holding tank sight glass. Efficient detergent cleaning of the shop and print towels is conducted to improve product cleanliness and maintain low dryer emissions. Towel Wash Room area source emissions are controlled by minimizing air contact with the soiled towels. Soiled towels are stored in covered plastic bins prior to washing. Immediately prior to washing, the towels are placed in slings for transfer to the washers and air exposure is minimized.

Figure 2-1 Process Flow Design



3.0 SUMMARY AND DISCUSSION OF RESULTS

The test was conducted in accordance with the protocol with modifications that are identified in the discussions below. The Towel Wash Room temporary exhaust system was operated during the processing of shop towels in accordance with EPA Method 204 with a single NDO; the NDO face velocity was greater than 200 feet per minute and the temporary enclosure negative pressure was below -0.007 inches of water. The Towel Wash Room temporary exhaust system was operated during the processing of print towels in accordance with EPA Method 204 with multiple NDOs; the temporary enclosure negative pressure was maintained below -0.007 inches of water. The temporary enclosure on the Ellis washer vents and EQ Tank vents were also operated in compliance with EPA Method 204 with an opening face velocity greater than 200 feet per minute.

Sections 3.1 through 3.3 specify the methodology used to measure and calculate VOC, HAP, and RTAP emissions from the processing of shop towels (with and without the strip cycle) and print towels at the towel plant. Section 3.4 summarizes for informational purposes only an industrial hygiene evaluation, and Sections 3.5 and 3.6 provide waste water analytical data for each test day and customer SIC code information for each load processed, respectively.

3.1 Shop Towel Emissions without Stripping Cycle

A summary of total VOC and HAP emissions factors for the shop towel without the stripping cycle test are presented in Table 3-1. The facility-wide emission factor for total VOC is 7.1 pounds of emissions as carbon per 1000 pounds of soiled towel weight (lb/1000 lb) and the emission factor for total HAPs is 0.3 lb/1000 lb.

The VOC emission factors were determined for each source by measuring the average concentration in accordance with EPA Method 25A and emissions were calculated in accordance with the example calculations provided in Appendix K. Six shop towel washer loads and twelve dryer loads were processed during the test period which consisted of a 12.5 hour period. The first three wash loads were inadvertently washed with a wash formula developed for 900 pounds of soiled towels instead of for 1200 pounds of soiled towels. The correct wash formula was used for the remaining wash loads. Based on the VOC emissions measurements at the Ellis washer and the dryer stacks, the incremental change in wash formula between the first three wash loads and the last three wash loads did not cause an appreciable change in the emissions results. VOC emissions were measured over most of the period, although there were several breaks in the VOC monitoring (Method 25A) for calibrations.

The HAP emission factors were based on EPA Method TO-15 tests that were conducted during the processing of shop towels with the strip cycle and were determined for each source by summing the organic compounds listed in Title III of the 1990 Clean Air Act Amendments. HAP emission factors for the processing of shop towels without the strip cycle were then calculated based on the ratio of HAP (lb/hr) to VOC (lb/hr) emissions from the testing conducted on shop towels with the strip cycle multiplied by the VOC (lb/hr) emissions measured during testing of the shop towels without the strip cycle.

3.2 Shop Towel Emissions with Stripping Cycle

A summary of total VOC and HAP emissions data for the shop towel with the stripping cycle test are presented in Tables 3-2 and 3-3. The facility-wide emission factor for total VOC is 8.3 lb/1000 lb and the emission factor for total HAPs is 0.6 lb/1000 lb. No solvent was collected during any of the shop towel runs, as measured by the solvent holding tank sight glass at the Ellis systems before and after the strip and wash cycles.

The VOC emission factors were determined for each source by measuring the average concentration in accordance with EPA Method 25A as described above. Six shop towel washer loads and twelve dryer loads were processed during the test period which consisted of a 13.25 hour period. VOC emissions were measured over most of the period, although there were several breaks in the VOC monitoring (Method 25A) for calibrations.

The HAP emission factors were based on EPA Method TO-15 tests that were conducted during the processing of shop towels with the strip cycle and were determined for each source by summing the organic compounds listed in Title III of the 1990 Clean Air Act Amendments. Similar to the emission factor development for VOC, the stack test mass emission rate for the day of each HAP and RTAP was applied to the production rate during the stack test in order to develop a lb of pollutant per 1000 lb of soiled towel throughput. Table 3-3 presents a summary of HAP and RTAP emissions measured by EPA Method TO-15. Table 3-3 also denotes certain compounds that are not regulated VOC; however, as a conservative measure, these non-VOCs are not subtracted from the VOC emissions measured by Methods 25A.

There were six HAPs and ten RTAPs detected in one or more samples; HAPs and RTAPs that were not detected in all five samples are not shown in Table 3-3 and their respective emissions are treated as zero. If a HAP was detected in one or two samples, but non-detected in the other samples, a concentration of one half (½) the detection limit was used for the non-detect samples to calculate the total HAP emissions. This method of addressing non-detect samples is based on the EPA's Maximum Achievable Control Technology ("MACT") rule for the Plywood and Composite Wood Products in 40 CFR 63.2262(g)(2), which states the following:.

> *(2) When showing compliance with the production-based compliance options in Table 1A to this subpart, you may treat emissions of an individual HAP as zero if all three of the performance test runs result in a nondetect measurement, and the method detection limit is*

less than or equal to 1 parts per million by volume, dry basis (ppmvd). Otherwise, nondetect data for individual HAP must be treated as one-half of the method detection limit.

3.3 Print Towel Emissions

A summary of total VOC and HAP emissions data for the print towel test are presented in Tables 3-4 through 3-6. The VOC emission factors were determined for each source by measuring the average concentration in accordance with EPA Method 25A as described above. VOC emissions were measured over most of the period, although there were several breaks in the VOC monitoring (Method 25A) for calibrations.

The protocol specified four print towel washer loads for the test; however, only three loads were washed: two loads in Ellis Washer 1 (Loads 1 and 3) and one load in Ellis Washer 2 (Load 2). The load that was washed in Ellis Washer 2 (Load 2) was not considered representative of typical operating conditions due primarily to two activities: 1) during the strip cycle, vapors were observed in the form of steam escaping through the door seals and likely resulting in VOC concentrations at the wash room that were higher than that from Ellis Washer 1 (see Figure 3-1), and 2) a process alarm interruption occurred after the first half-hour of the strip cycle because the operating temperature was less than the process-required 200°F for an excessive period of time. The fact that Ellis Washer 2 was unable to maintain the operating temperature during the strip cycle as compared to Ellis Washer 1 may have been due to large volumes of cold air by nearby NDOs being swept over and around the Ellis Washer 2 and induced through the wash room exhaust located behind Ellis Washer 2.

The fourth washer load in Ellis Washer 2 could not be completely washed because the facility steam generator tripped when the blower motor failed and could not be repaired. The protocol also specified eight dryer loads for the test; however, only six dryer loads were processed (four loads from Ellis Washer 1 and two loads from Ellis Washer 2).

Per discussion with Bill Osbahr of the EPA on December 27 it was determined that the Print Towel emission factors should be reported for two operating scenarios: Scenario 1 that presents emissions factors based on only Loads 1 and 3 emissions from Ellis Washer 1, dryer emissions from drying only Loads 1 and 3 towels washed in Ellis Washer 1, and all wash room air emissions during the test day (including any wash room emissions from Load 2 and the beginning of Load 4), and Scenario 2 that presents emission factors using Loads 1, 2, and 3 emissions from both Ellis washers, all associated dryer load emissions, and emissions from the wash room.

Table 3-4 presents the VOC emission factors for Scenario 1. The facility-wide emission factor for total VOC is 56.4 lb/1000 lb and the emission factor for total HAPs is 1.1 lb/1000 lb.

Table 3-5 presents the VOC emission factors for Scenario 2. The facility-wide emission factor for total VOC is 68.8 lb/1000 lb and the emission factor for total HAPs is 1.3 lb/1000 lb.

For all three processed print towel loads, the condenser temperature throughout the strip cycle was less than the 120°F manufacturer high-temperature level recommendation, relying on the locked valve setting of condenser cooling water flow that was established during the June 2012 optimization test. The approximate amount of solvent collected in the Loads 1, 2, and 3 were 59, 49, and 70 pounds, respectively. The strip cycle times for Loads 1 and 3 were 93 and 86 minutes, respectively. The strip cycle times were a result of the solvent flow indicator sensor signifying a ratable decrease in solvent recovery at approximately 73 and 66 minutes after the start of the strip cycle, respectively, followed by an additional 20 minutes of steam stripping without the sensor indicating presence of solvent in the recovery line. The Load 2 strip cycle time was approximately 120 minutes excluding the operational interruption described above and also noting that the first half-hour of the strip cycle was at a less-than-optimal strip temperature.

Per discussion with Bill Osbahr of the EPA at the close-out meeting on November 29 and as indicated above, all of the measured emissions from the Towel Wash Room for the test day, including that for sorting and processing of Load 2 and for the sorting and initial processing of Load 4 before the steam generator trip, are included in both sets of the aforementioned emissions factors. For informational purposes, Figure 3-1 displays minute-by-minute VOC concentration data at the Towel Wash Room enclosure exhaust in conjunction with the start and end times for the four print towel loads. An analysis to estimate the VOC emissions from only processing Loads 1 and 3 at Ellis by removing the contributions of Loads 2 and 4 was not completed due to the overlap of the wash loads. A conservatively high emissions factor for the Towel Wash Room is calculated for both operating scenarios by dividing all of the VOC emissions for the test day by 2,700 lb of soiled towels to represent completed Loads 1 through 3. The VOC emissions from the sorting and initial processing of Load 4 are conservatively included in the VOC emissions numerator, but since the load was not completed, the denominator was not updated to reflect four loads at 3,600 lb total.

The HAP emission factors were based on EPA Method TO-15 tests that were determined for each source by summing the organic compounds listed in Title III of the 1990 Clean Air Act Amendments. The same methodology for the treatment of non-detect samples and for calculating HAP and RTAP that is explained in Section 3.2 was utilized the for shop towels with the strip cycle test was also used for the print towel test. Table 3-6 presents a summary of HAP and RTAP emissions measured by EPA Method TO-15.

3.4 Towel Wash Room Industrial Hygiene Evaluation

The emissions tests were conducted with special operating conditions which included closing doors in the Wash Room, controlling the Wash Room ventilation, and processing only one towel type per day. These special operating conditions were expected to create a worst case for VOC concentrations in the room during the print towel test. Total VOC was periodically monitored in the Wash Room with a portable organic vaporizer analyzer and the Method TO-15 tests provided average concentrations of specific organic compounds that can be compared to work place exposure limits. During the print towel test conducted on November 29, 2012 the Method TO-15 data from the Towel Wash Room showed that average concentrations were below the OSHA permissible exposure limits (PELs) expressed as time weighted averages (TWAs). A comparison of Wash Room concentrations to the TWAs are shown in Table 3-6 for both the print towel and shop towel with strip cycle tests.

3.5 Waste Water Evaluation

Pursuant to the Wastewater Sampling and Analysis Plan approved as part of the Test Protocol, G&K personnel collected wastewater grab samples for each day of emissions testing for shop towels. In addition, G&K voluntarily collected wastewater grab samples for the day emission testing was conducted for print towels. A total of three wastewater grab samples were obtained each test day. The daily grab samples were collected in the morning, mid-day and at the end of each sampling day, respectively. All grab samples were obtained from the sampling point specified in the plant's Industrial User Wastewater Discharge permit, No. 1066 (DAF effluent).

After collection, the grab samples were analyzed by a local laboratory, ChemServe Environmental Analysts out of Milford, for flash point, total toxic organics (TTOs) and oil and grease (O&G). The respective analytical methods utilized by the laboratory were SW-1010, EPA 1664A and EPA 624. Analyses of these three parameters demonstrated that all oil and grease samples were less than 5.2 mg/l or the respective level of detection (5.0 mg/l), all flashpoint samples were greater than 165 degrees Fahrenheit, and the total organic toxics samples were less than 1300 ug/l (based upon the aggregation of the 624 compounds detected). Copies of the actual analytical results are presented in Appendix F.

3.6 Customer SIC Code Reporting

Also pursuant to the approved Test Protocol, G&K gathered information on the 2-digit Standard Industrial Classification (SIC) code of each customer for which soiled shop and print towels were processed during the test. Each bag of soiled towels processed during the test had a "soil tag" that manually records the date, route and customer information. As the product was processed for the test, the weight of product associated with each soil tag was recorded. In a few cases, the soil tag was not on the bag and the customer data was unknown for those particular weights of product. During the November 2012 emission testing, customer information from the soil tags was collected and entered into a spreadsheet. Appendix I provides the percentage by weight of each load affiliated with each 2-digit SIC code.

Table 3-1
Shop Towels - No Strip Emission Factors
G&K Services, Inc - November 27, 2012

Source	Emission Period Start Time	Emission Period Stop Time	Emission Period Duration (hours) [1]	Soiled Towel Weight (lbs) [2]	Average TOC (ppmC) [3]	Exhaust Flow Rate (scfm)	Average VOC (lb/hour) [4]	Total VOC Emitted During Test Period (lb) [5]	VOC Emission Factor (lb/1000lb) [6]	EPA TO-15 Total HAPs (lb/hour)	Total HAP Emitted During Test Period (lb) [5]	HAP Emission Factor (lb/1000lb) [6]
Towel Wash Room	8:00	20:30	12.50	7200	26.4	11424	0.56	7.03	0.98	0.139	1.73	0.241
Ellis Washer 1	8:00	20:30	4.57	3600	174.3	342	0.11	0.51	0.14	0.022	0.10	0.027
Ellis Washer 2	8:00	20:30	4.35	3600	157.8	313	0.09	0.40	0.11	0.023	0.10	0.027
Dryer (On)	8:00	20:30	7.01	7200	593.8	5403	5.98	41.94	5.83	0.006	0.040	0.006
Dryer (Off)	8:00	20:30	5.49	7200	26.5	100	0.005	0.03	0.004	0.002	0.01	0.001
Combined Sources									7.1			0.3

1. Twelve shop towel loads were washed and dried and total facility emissions were measured over this duration. Period began when the the first soiled laundry bags were opened and ended when the Towel Wash Room VOC concentration returned to background level.
2. Soiled towel weight is the combined weight of 6 washer loads (6 loads x 1200 lb/load).
3. Average TOC data reported in ppm as carbon are based on EPA Method 25A measurements throughout the emission period.
4. VOC emission rate is calculated from the Method 25A average VOC concentration and the measured gas flow rate. The calculation is as follows;
   lb/hour = ppmC x scfm x 12 x 2.59E-9 x 60
   Example (Towel Wash Room VOC): lb/hour = 26.4 x 11424 x 12x 2.59E-9 x 60 = .56
5. Total VOC or HAP emitted during the emission period is calculated as follows:
   lb = lb/hour x hours   Example (Towel Wash Room VOC): lb = .56 x 12.5 = 7.03 Example 2 (Towel Wash Room HAP): lb = .139 x 12.5 = 1.73
6. VOC and HAP emission factors reported as pounds of emissions (VOC is as carbon) per 1000 pounds of soiled towel weight is calculated as follows:
   lb/1000 lb = lb/lb x 1000 Example 1 (Towel Wash Room VOC): lb/1000 lb = 7.03/7200 x 1000 = 0.98   Example 2 (Towel Wash Room HAP): lb/1000lb = 1.73/7200 x 1000 = 0.241

Table 3-2
Shop Towels - With Strip Emission Factors
G&K Services, Inc - November 28, 2012

Source	Emission Period Start Time	Emission Period Stop Time	Emission Period Duration (hours) [1]	Soiled Towel Weight (lbs) [2]	Average TOC (ppmC) [3]	Exhaust Flow Rate (scfm)	Average VOC (lb/hour) [4]	Total VOC Emitted During Test Period (lb) [5]	VOC Emission Factor (lb/1000lb) [6]	EPA TO-15 Total HAPs (lb/hour)	Total HAP Emitted During Test Period (lb) [5]	HAP Emission Factor (lb/1000lb) [6]
Towel Wash Room	7:45	21:00	13.25	7200	44.9	11224	0.94	12.44	1.73	0.246	3.26	0.453
Ellis Washer 1	7:45	21:00	6.17	3600	195.1	335	0.12	0.75	0.21	0.032	0.20	0.055
Ellis Washer 2	7:45	21:00	6.62	3600	258.4	293	0.14	0.93	0.26	0.053	0.35	0.097
Dryer (On)	7:45	21:00	6.98	7200	622.2	5429	6.30	43.97	6.11	0.006	0.042	0.006
Dryer (Off)	7:45	21:00	6.27	7200	88.6	100	0.02	0.10	0.01	0.004	0.03	0.004
Combined Sources									8.3			0.6

1. Six shop towel loads were washed and dried and total facility emissions were measured over this duration. Period began when the the first soiled laundry bags were opened and ended when the Towel Wash Room VOC concentration returned to background level.
2. Soiled towel weight is the combined weight of 6 washer loads (6 loads x 1200 lb/load).
3. Average TOC data reported in ppm as carbon are based on EPA Method 25A measurements throughout the emission period.
4. VOC emission rate is calculated from the Method 25A average VOC concentration and the measured gas flow rate. The calculation is as follows;
   lb/hour = ppmC x scfm x 12 x 2.59E-9 x 60
   Example (Towel Wash Room VOC): lb/hour = 44.9 x 11224 x 12x 2.59E-9 x 60 = 0.94
5. Total VOC or HAP emitted during the emission period is calculated as follows:
   lb = lb/hour x hours Example (Towel Wash Room VOC): lb = .94 x 13.25 = 12.44 Example 2 (Towel Wash Room HAP): lb = .246 x 13.25 = 3.26
6. VOC and HAP emission factors reported as pounds of emissions (VOC is as carbon) per 1000 pounds of soiled towel weight is calculated as follows:
   lb/1000 lb = lb/lb x 1000 Example 1 (Towel Wash Room VOC): lb/1000 lb = 12.44/7200 x 1000 = 1.73 Example 2 (Towel Wash Room HAP): lb/1000lb = 3.26/7200 x 1000 = 0.45

Table 3-3
Shop Towels With Strip Cycle HAP and RTAP Emissions - EPA Method TO-15
G&K Services, Inc. - Manchester, NH - November 28, 2012

Location		Dryer	Washer 1	Washer 2	Wash Room	
Test		D-1	W1-1	W2-1	RA-1	RA-2
Time		11:06 - 21:00	08:50 - 16:59	10:00 - 19:08	08:00 - 14:00	14:30 - 21:00
Stack Data						
Temperature (°F)		159	38	40	61	61
Flow Rate (scfm)		5429	335	293	11224	11224
Moisture (%)		4.5	0.7	0.7	0.9	0.9
Propene	V, N					
Concentration (ppm)		0.003	< 0.026	< 0.065	0.017	< 0.004
Emission Rate (lb/hr)		8.9E-05	< 5.6E-05	< 1.2E-04	1.2E-03	< 2.7E-04
Dichlorodifluoromethane						
Concentration (ppm)		0.0017	< 0.009	< 0.023	< 0.001	< 0.001
Emission Rate (lb/hr)		1.7E-04	< 5.7E-05	< 1.3E-04	< 2.6E-04	< 2.7E-04
Ethanol	V, N					
Concentration (ppm)		< 0.002	< 0.230	< 0.600	0.360	0.340
Emission Rate (lb/hr)		< 8.7E-05	< 5.5E-04	< 1.3E-03	2.9E-02	2.7E-02
Acetone	N					
Concentration (ppm)		0.267	< 0.185	< 0.425	0.150	0.094
Emission Rate (lb/hr)		1.3E-02	< 5.6E-04	< 1.1E-03	1.5E-02	9.5E-03
Trichlorofluoromethane						
Concentration (ppm)		0.0013	< 0.008	< 0.010	< 0.001	< 0.001
Emission Rate (lb/hr)		1.5E-04	< 5.4E-05	< 6.3E-05	< 2.6E-04	< 2.8E-04
2-Propanol	V, N					
Concentration (ppm)		< 0.002	0.600	< 0.460	0.300	0.130
Emission Rate (lb/hr)		< 8.9E-05	1.9E-03	< 1.3E-03	3.1E-02	1.4E-02
Carbon Disulfide						
Concentration (ppm)		0.006	< 0.140	< 0.365	< 0.020	< 0.021
Emission Rate (lb/hr)		3.6E-04	< 5.5E-04	< 1.3E-03	< 2.6E-03	< 2.7E-03
Ethyl Acetate						
Concentration (ppm)		0.0005	< 0.024	< 0.065	0.007	< 0.004
Emission Rate (lb/hr)		3.5E-05	< 1.1E-04	< 2.6E-04	1.1E-03	< 5.4E-04
n-Hexane	V, H, N					
Concentration (ppm)		0.001	0.047	0.077	< 0.002	0.005
Emission Rate (lb/hr)		9.5E-05	2.1E-04	3.0E-04	<2.6E-04	6.76E-04
1,2 Dichloroethane	V, H, N					
Concentration (ppm)		0.0020	< 0.011	0.060	0.003	0.005
Emission Rate (lb/hr)		1.6E-04	< 5.7E-05	2.7E-04	5.2E-04	7.8E-04
Benzene						
Concentration (ppm)		0.003	< 0.014	< 0.036	< 0.002	< 0.002
Emission Rate (lb/hr)		1.7E-04	< 5.5E-05	< 1.3E-04	< 2.6E-04	< 2.7E-04
Cyclohexane						
Concentration (ppm)		0.001	< 0.026	< 0.065	< 0.004	< 0.004
Emission Rate (lb/hr)		7.0E-05	< 1.1E-04	< 2.5E-04	< 5.2E-04	< 5.4E-04
Trichloroethene	V, H, N					
Concentration (ppm)		0.0014	< 0.008	< 0.021	< 0.001	< 0.001
Emission Rate (lb/hr)		1.6E-04	< 5.5E-05	< 1.3E-04	< 2.6E-04	< 2.8E-04
n-Heptane	V, N					
Concentration (ppm)		0.017	0.720	0.860	0.086	0.056
Emission Rate (lb/hr)		1.4E-03	3.8E-03	3.9E-03	1.5E-02	9.8E-03
4-Methyl-2-pentanone	V, N					
Concentration (ppm)		< 0.0624	0.027	< 0.028	0.011	0.011
Emission Rate (lb/hr)		< 5.3E-03	1.4E-04	< 1.3E-04	1.9E-03	1.9E-03
Toluene	V, H, N					
Concentration (ppm)		0.033	3.700	8.400	0.800	0.950
Emission Rate (lb/hr)		2.5E-03	1.8E-02	3.5E-02	1.3E-01	1.5E-01

Table 3-3
Shop Towels With Strip Cycle HAP and RTAP Emissions - EPA Method TO-15
G&K Services, Inc. - Manchester, NH - November 28, 2012

Location		Dryer	Washer 1	Washer 2	Wash Room	
Test		D-1	W1-1	W2-1	RA-1	RA-2
Time		11:06 - 21:00	08:50 - 16:59	10:00 - 19:08	08:00 - 14:00	14:30 - 21:00
n-Butyl Acetate						
Concentration (ppm)		< 0.0001	0.160	< 0.024	0.014	< 0.001
Emission Rate (lb/hr)		< 8.8E-06	9.7E-04	< 1.3E-04	2.8E-03	< 2.7E-04
n-Octane	V, N					
Concentration (ppm)		0.0005	0.130	0.120	0.019	0.008
Emission Rate (lb/hr)		4.5E-05	7.7E-04	6.2E-04	3.8E-03	1.6E-03
Tetrachloroethene	H, N					
Concentration (ppm)		0.013	0.980	1.900	0.400	0.160
Emission Rate (lb/hr)		1.9E-03	8.5E-03	1.4E-02	1.2E-01	4.6E-02
Ethylbenzene	V, H, N					
Concentration (ppm)		0.0017	0.170	0.087	0.022	0.018
Emission Rate (lb/hr)		1.5E-04	9.4E-04	4.2E-04	4.1E-03	3.3E-03
m,p-Xylenes	V, H, N					
Concentration (ppm)		0.0048	0.5800	0.3000	0.0810	0.0620
Emission Rate (lb/hr)		4.3E-04	3.2E-03	1.5E-03	1.5E-02	1.1E-02
o-Xylene	V, H, N					
Concentration (ppm)		0.0018	0.190	0.100	0.030	0.023
Emission Rate (lb/hr)		1.6E-04	1.1E-03	4.8E-04	5.6E-03	4.3E-03
n-Nonane	V, N					
Concentration (ppm)		0.001	0.270	0.180	0.046	0.027
Emission Rate (lb/hr)		5.5E-05	1.8E-03	1.1E-03	1.0E-02	6.0E-03
Cumene	V, H, N					
Concentration (ppm)		< 0.0001	0.030	< 0.023	0.003	< 0.001
Emission Rate (lb/hr)		< 8.6E-06	1.9E-04	< 1.3E-04	5.7E-04	< 2.7E-04
n-Propylbenzene	V					
Concentration (ppm)		< 0.0053	0.096	< 0.023	0.009	0.009
Emission Rate (lb/hr)		< 5.3E-04	6.0E-04	< 1.3E-04	2.0E-03	1.9E-03
4-Ethyltoluene	V					
Concentration (ppm)		0.0003	0.140	0.054	0.015	0.015
Emission Rate (lb/hr)		2.8E-05	8.8E-04	3.0E-04	3.1E-03	3.1E-03
1,3,5-Trimethylbenzene	V, N					
Concentration (ppm)		0.0055	0.120	0.049	0.017	0.017
Emission Rate (lb/hr)		5.5E-04	7.5E-04	2.7E-04	3.6E-03	3.6E-03
1,2,4-Trimethylbenzene	V, N					
Concentration (ppm)		0.006	0.280	0.090	0.046	0.047
Emission Rate (lb/hr)		6.1E-04	1.8E-03	4.9E-04	9.6E-03	9.9E-03
d-Limonene	V					
Concentration (ppm)		0.003	0.030	< 0.021	0.018	0.029
Emission Rate (lb/hr)		3.0E-04	2.1E-04	< 1.3E-04	4.3E-03	6.9E-03
Naphthalene	V, H,N					
Concentration (ppm)		< 0.0049	< 0.009	< 0.022	< 0.001	0.003
Emission Rate (lb/hr)		< 5.3E-04	< 5.7E-05	< 1.3E-04	< 2.6E-04	6.0E-04
Total Federal HAP Emissions						
Concentration (ppm)		0.06	5.72	10.99	1.34	1.23
Emission Rate (lb/hr)		0.006	0.032	0.053	0.271	0.221
Wash Room Average (lb/hr)					0.246	

Notes:

V = Volatile Organic Compound

H = Federally Regulated Hazardous Air Pollutant (HAP)

N = New Hampshire Department of Environmental Services Regulated Toxic Air Pollutant

concentrations of non-detect compounds entered at 1/2 of the detection limit

Table 3-4
Print Towels Emission Factors - Scenario 1
G&K Services, Inc - November 29, 2012

Source	Emission Period Start Time	Emission Period Stop Time	Emission Period Duration (hours) [1]	Soiled Towel Weight (lbs) [2]	Average TOC (ppmC) [3]	Exhaust Flow Rate (scfm)	Average VOC (lb/hour) [4]	Total VOC Emitted During Test Period (lb) [5]	VOC Emission Factor (lb/1000lb) [6]	EPA TO-15 Total HAPs (lb/hour)	Total HAP Emitted During Test Period (lb) [5]	HAP Emission Factor (lb/1000lb) [6]
Towel Wash Room	7:30	17:33	10.05	2700	144.0	11374	3.05	30.69	11.37	0.242	2.43	0.901
Ellis Washer 1	7:30	17:33	6.83	1800	353.1	343	0.23	1.54	0.86	0.050	0.34	0.190
Dryer (On)	7:30	17:33	2.48	1800	3203.3	5357	32.00	79.36	44.09	0.010	0.025	0.014
Dryer (Off)	7:30	17:33	6.33	2700	176.7	100	0.03	0.21	0.08	0.003	0.02	0.006
Combined Sources									56.4			1.1

1. Four print towel loads were sorted. Three loads were washed (two loads in Washer 1 and 1 load in Washer 2) and two loads were dried. Total facility emissions were measured over this duration. The test period began when the the first soiled laundry bags were opened and ended when the Towel Wash Room VOC concentration returned to the background level.
2. Soiled towel weight is the combined weight of 4 washer loads (4 loads x 900 lb/load).
3. Average TOC data reported in ppm as carbon are based on EPA Method 25A measurements throughout the emission period.
4. VOC emission rate is calculated from the Method 25A average VOC concentration and the measured gas flow rate. The calculation is as follows;
   lb/hour = ppmC x scfm x 12 x 2.59E-9 x 60
   Example (Towel Wash Room VOC): lb/hour = 144.0 x 11374 x 12x 2.59E-9 x 60 = 3.05
5. Total VOC or HAP emitted during the emission period is calculated as follows:
   lb = lb/hour x hours   Example (Towel Wash Room VOC): lb = 3.05 x 10.05 = 30.69 Example 2 (Towel Wash Room HAP): lb = .242 x 10.05 = 2.43
6. VOC and HAP emission factors reported as pounds of emissions (VOC is as carbon) per 1000 pounds of soiled towel weight is calculated as follows:
   lb/1000 lb = lb/lb x 1000 Example 1 (Towel Wash Room VOC): lb/1000 lb = 30.69/2700 x 1000 = 11.37   Example 2 (Towel Wash Room HAP): lb/1000lb = 2.43/2700 x 1000 = 0.901

Table 3-5
Print Towels Emission Factors - Scenario 2
G&K Services, Inc - November 29, 2012

Source	Emission Period Start Time	Emission Period Stop Time	Emission Period Duration (hours) [1]	Soiled Towel Weight (lbs) [2]	Average TOC (ppmC) [3]	Exhaust Flow Rate (scfm)	Average VOC (lb/hour) [4]	Total VOC Emitted During Test Period (lb) [5]	VOC Emission Factor (lb/1000lb) [6]	EPA TO-15 Total HAPs (lb/hour)	Total HAP Emitted During Test Period (lb) [5]	HAP Emission Factor (lb/1000lb) [6]
Towel Wash Room	7:30	17:33	10.05	2700	144.0	11374	3.05	30.69	11.37	0.242	2.43	0.901
Ellis Washer 1	7:30	17:33	6.83	1800	353.1	343	0.23	1.54	0.86	0.050	0.34	0.190
Ellis Washer 2	7:30	17:33	3.53	900	574.2	296	0.32	1.12	1.24	0.040	0.14	0.157
Dryer (On)	7:30	17:33	3.72	2700	4006.8	5369	40.12	149.07	55.21	0.010	0.037	0.014
Dryer (Off)	7:30	17:33	6.33	2700	176.7	100	0.03	0.21	0.08	0.003	0.02	0.006
Combined Sources									68.8			1.3

1. Four print towel loads were sorted. Three loads were washed (two loads in Washer 1 and 1 load in Washer 2) and six loads were dried. Total facility emissions were measured over this duration. The test period began when the the first soiled laundry bags were opened and ended when the Towel Wash Room VOC concentration returned to the background level.
2. Soiled towel weight is the combined weight of 3 washer loads (3 loads x 900 lb/load).
3. Average TOC data reported in ppm as carbon are based on EPA Method 25A measurements throughout the emission period.
4. VOC emission rate is calculated from the Method 25A average VOC concentration and the measured gas flow rate. The calculation is as follows;
   lb/hour = ppmC x scfm x 12 x 2.59E-9 x 60
   Example (Towel Wash Room VOC): lb/hour = 144.0 x 11374 x 12x 2.59E-9 x 60 = 3.05
5. Total VOC or HAP emitted during the emission period is calculated as follows:
   lb = lb/hour x hours   Example (Towel Wash Room VOC): lb = 3.05 x 10.05 = 30.69 Example 2 (Towel Wash Room HAP): lb = .242 x 10.05 = 2.43
6. VOC and HAP emission factors reported as pounds of emissions (VOC is as carbon) per 1000 pounds of soiled towel weight is calculated as follows:
   lb/1000 lb = lb/lb x 1000 Example 1 (Towel Wash Room VOC): lb/1000 lb = 30.69/2700 x 1000 = 11.37   Example 2 (Towel Wash Room HAP): lb/1000lb = 2.43/2700 x 1000 = 0.901

Table 3-6
Print Towels HAP and RTAP Emissions - EPA Method TO-15
G&K Services, Inc. - Manchester, NH - November 29, 2012

Location		Dryer	Washer 1	Washer 2	Wash Room	
Test		D-2	W1-2	W2-2	RA-3	RA-4
Time		11:38 - 16:43	08:03 - 15:04	09:30 - 13:16	07:30 - 14:00	14:20 - 16:45
Stack Data						
Temperature (^{o}F)		161	46	46	56	56
Flow Rate (scfm)		5357	343	292	11374	11374
Moisture (%)		4.0	0.7	0.8	0.8	0.8
Propene	V, N					
Concentration (ppm)		< 0.001	0.180	0.280	0.110	0.08
Emission Rate (lb/hr)		< 5.1E-05	4.0E-04	5.3E-04	8.2E-03	6.0E-03
Acetone	N					
Concentration (ppm)		5.896	8.300	8.300	3.300	3.100
Emission Rate (lb/hr)		2.9E-01	2.6E-02	2.2E-02	3.4E-01	3.2E-01
2-Propanol	V, N					
Concentration (ppm)		< 0.010	2.400	1.900	0.950	0.700
Emission Rate (lb/hr)		< 5.00E-04	7.69E-03	5.18E-03	1.01E-01	7.44E-02
Ethyl Acetate						
Concentration (ppm)		< 0.001	< 0.047	0.049	< 0.006	< 0.005
Emission Rate (lb/hr)		< 1.0E-04	< 2.2E-04	2.0E-04	< 8.6E-04	< 7.8E-04
n-Hexane	V, H, N					
Concentration (ppm)		0.003	1.900	4.800	0.300	0.570
Emission Rate (lb/hr)		2.4E-04	8.7E-03	1.9E-02	4.6E-02	8.68E-02
Cyclohexane						
Concentration (ppm)		< 0.001	1.300	2.800	0.250	0.510
Emission Rate (lb/hr)		< 1.0E-04	5.8E-03	1.1E-02	3.7E-02	7.6E-02
n-Heptane	V, N					
Concentration (ppm)		< 0.001	0.300	1.500	0.081	0.035
Emission Rate (lb/hr)		< 5.0E-05	1.6E-03	6.8E-03	1.4E-02	6.2E-03
4-Methyl-2-pentanone	V, N					
Concentration (ppm)		< 0.152	0.042	0.700	0.079	0.016
Emission Rate (lb/hr)		< 1.3E-02	2.2E-04	3.2E-03	1.4E-02	2.8E-03
Toluene	V, H, N					
Concentration (ppm)		0.022	7.900	2.200	0.430	0.320
Emission Rate (lb/hr)		1.7E-03	3.9E-02	9.2E-03	7.0E-02	5.2E-02
n-Butyl Acetate						
Concentration (ppm)		< 0.001	< 0.018	0.018	0.004	< 0.004
Emission Rate (lb/hr)		< 5.3E-05	< 1.1E-04	9.5E-05	9.0E-04	< 8.0E-04
n-Octane	V, N					
Concentration (ppm)		0.005	0.250	0.055	0.035	0.048
Emission Rate (lb/hr)		4.8E-04	1.5E-03	2.9E-04	7.1E-03	9.7E-03
Tetrachloroethene	H, N					
Concentration (ppm)		0.003	0.110	0.490	0.034	0.034
Emission Rate (lb/hr)		4.3E-04	9.7E-04	3.7E-03	1.0E-02	1.0E-02
Ethylbenzene	V, H, N					
Concentration (ppm)		0.008	0.170	0.320	0.077	0.066
Emission Rate (lb/hr)		7.1E-04	9.6E-04	1.5E-03	1.4E-02	1.2E-02
m,p-Xylenes	V, H, N					
Concentration (ppm)		0.024	0.610	1.100	0.300	0.270
Emission Rate (lb/hr)		2.1E-03	3.5E-03	5.3E-03	5.6E-02	5.1E-02
o-Xylene	V, H, N					
Concentration (ppm)		0.014	0.210	0.470	0.140	0.110
Emission Rate (lb/hr)		1.2E-03	1.2E-03	2.3E-03	2.6E-02	2.1E-02
n-Nonane	V, N					
Concentration (ppm)		0.051	0.600	0.990	0.390	0.320
Emission Rate (lb/hr)		5.4E-03	4.1E-03	5.8E-03	8.8E-02	7.3E-02
Cumene	V, H, N					
Concentration (ppm)		0.005	0.048	0.170	0.058	0.035
Emission Rate (lb/hr)		4.8E-04	3.1E-04	9.3E-04	1.2E-02	7.4E-03

Table 3-6
Print Towels HAP and RTAP Emissions - EPA Method TO-15
G&K Services, Inc. - Manchester, NH - November 29, 2012

Location		Dryer	Washer 1	Washer 2	Wash Room	
Test		D-2	W1-2	W2-2	RA-3	RA-4
Time		11:38 - 16:43	08:03 - 15:04	09:30 - 13:16	07:30 - 14:00	14:20 - 16:45
n-Propylbenzene	V					
Concentration (ppm)		0.041	0.170	0.560	0.058	0.035
Emission Rate (lb/hr)		4.1E-03	1.1E-03	3.1E-03	1.2E-02	7.4E-03
4-Ethyltoluene	V					
Concentration (ppm)		0.051	0.250	0.710	0.380	0.320
Emission Rate (lb/hr)		5.1E-03	1.6E-03	3.9E-03	8.1E-02	6.8E-02
1,3,5-Trimethylbenzene	V, N					
Concentration (ppm)		0.073	0.220	0.730	0.410	0.310
Emission Rate (lb/hr)		7.3E-03	1.4E-03	4.0E-03	8.7E-02	6.6E-02
1,2,4-Trimethylbenzene	V, N					
Concentration (ppm)		0.183	0.480	1.500	0.790	0.780
Emission Rate (lb/hr)		1.8E-02	3.1E-03	8.2E-03	1.7E-01	1.7E-01
d-Limonene	V					
Concentration (ppm)		0.039	0.095	0.057	0.074	0.120
Emission Rate (lb/hr)		4.4E-03	6.9E-04	3.5E-04	1.8E-02	2.9E-02
Naphthalene	V, H,N					
Concentration (ppm)		0.016	< 0.016	< 0.004	0.004	0.036
Emission Rate (lb/hr)		1.7E-03	< 1.1E-04	< 2.5E-05	9.7E-04	8.2E-03
Total Federal HAP Emissions						
Concentration (ppm)		0.1	11.0	9.6	1.3	1.4
Emission Rate (lb/hr)		0.01	0.05	0.04	0.24	0.25
Wash Room Average (lb/hr)					0.242	

Notes:

V = Volatile Organic Compound

H = Federally Regulated Hazardous Air Pollutant (HAP)

N = New Hampshire Department of Environmental Services Regulated Toxic Air Pollutant

concentrations of non-detect compounds entered at 1/2 of the detection limit

Table 3-7 Industrial Hygiene Evaluation Based on Towel Wash Room Method TO-15 G&K Services, Inc.

Compound	Shop Towel Test Wash Room Concentrations (ppm) November 28, 2012	Print Towel Test Wash Room Concentrations (ppm) November 29, 2012	OSHA PELs - TWA (ppm)
Ethanol	0.35	ND	1000
Acetone	0.12	3.2	1000
2-propanol	0.22	0.83	400
2-butanone	ND	ND	200
methylene chloride	ND	ND	25
n-hexane	ND	0.44	500
1,2-dichloroethane (PEL is listed for 1,1 isomer)	ND	ND	100
n-heptane	0.07	0.06	500
4-methyl-2-pentanone	0.01	0.05	150
toluene	0.88	0.38	200
n-butyl acetate	0.01	0.004	150
n-octane	0.01	0.04	500
tetrachloroethene	0.28	0.03	100
ethylbenzene	0.02	0.07	100
m,p,o-xylenes	0.10	0.41	100
cumene	0.002	0.05	50
trimethyl benzene (all isomers)	0.06	1.15	25*
naphthalene	0.002	0.02	10

*Note: Trimethylbenzenes limit is based on ACGIC TLV limit as there is no OSHA PEL.

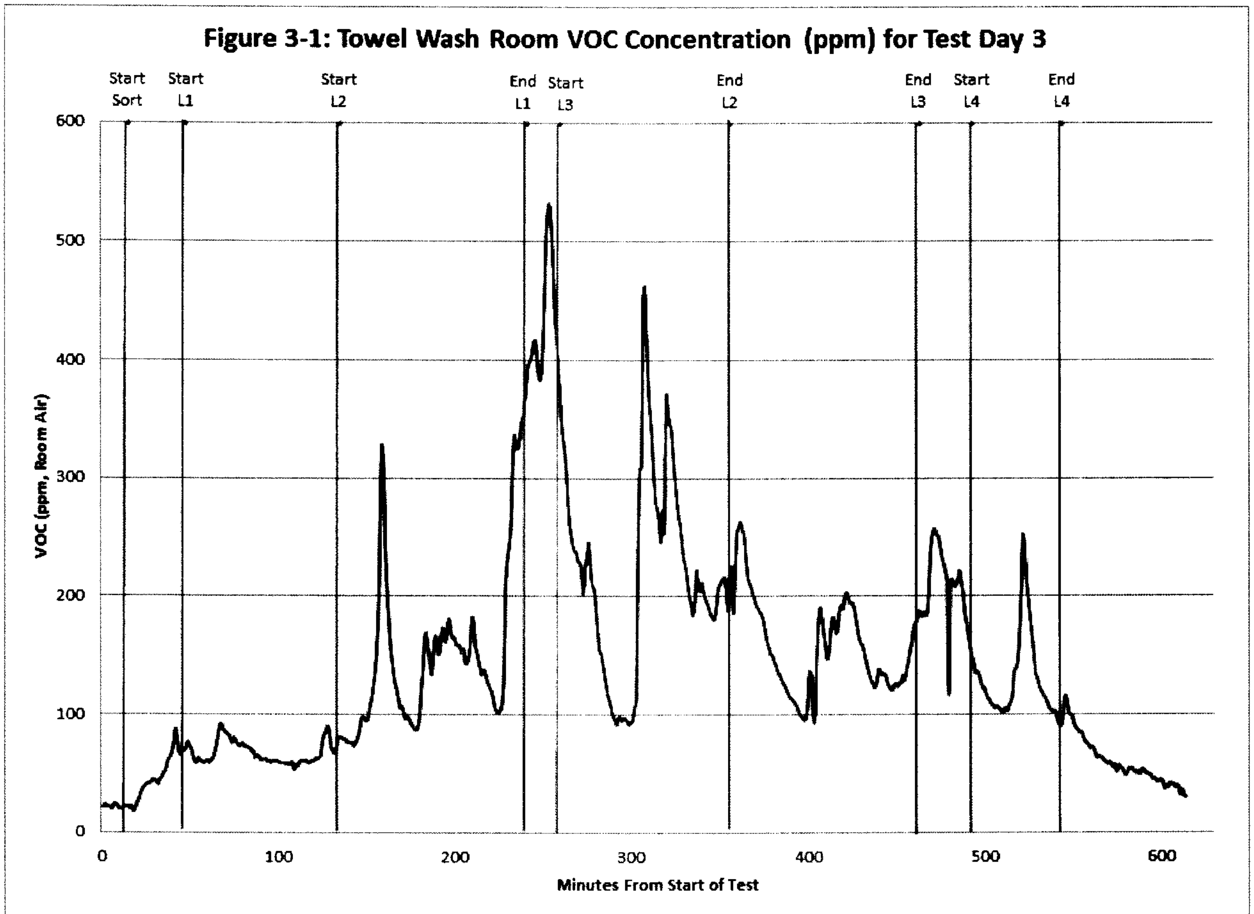


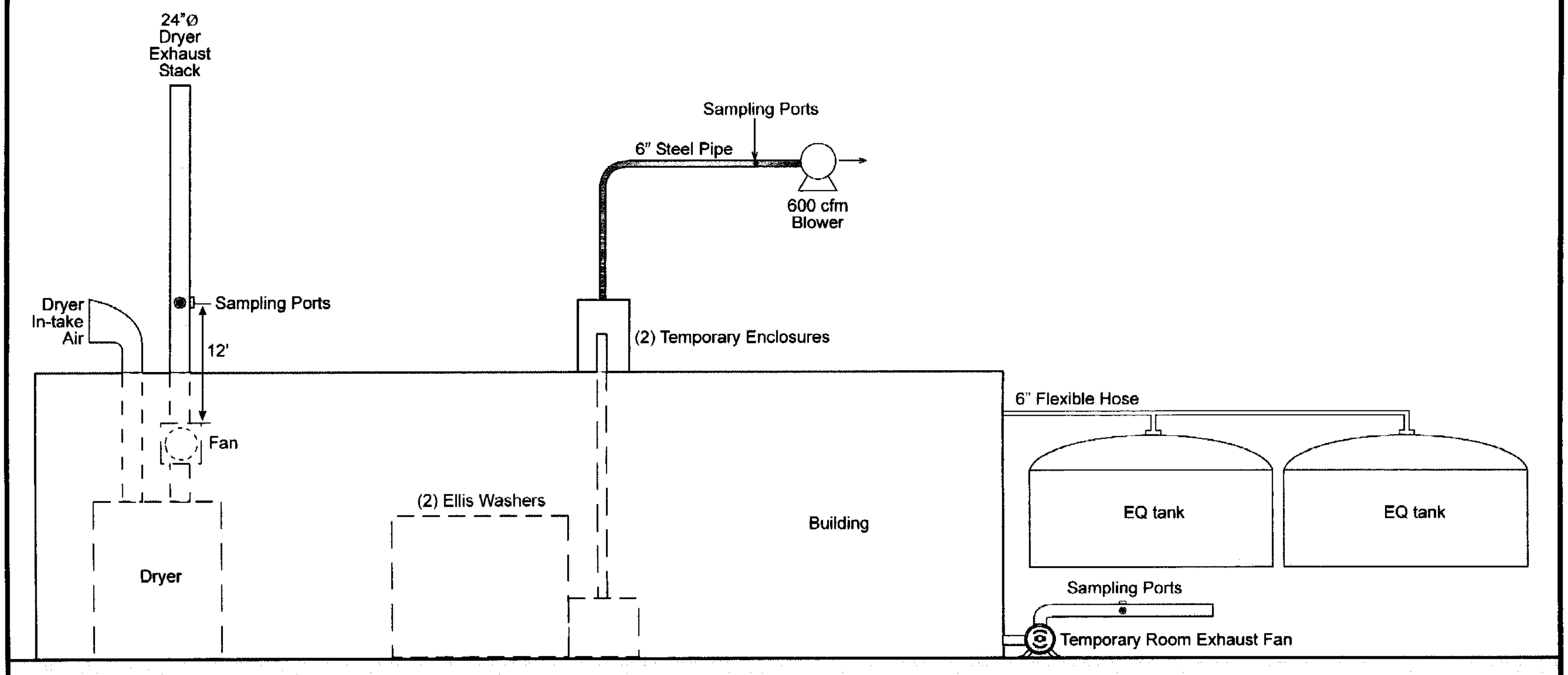
Figure 3-1: Towel Wash Room VOC Concentration (ppm) for Test Day 3
Start Sort
Start L1
Start L2
End L1
Start L3
End L2
End L3
Start L4
End L4
VOC (ppm, Room Air)
600
500
400
300
200
100
0
0
100
200
300
400
500
600
Minutes From Start of Test

4.0 SAMPLING LOCATIONS

Emission tests were conducted at the following four locations at the Facility: (1,2) the two temporary total enclosures around the Ellis Washer system stacks, which are accessed from the roof; (3) dryer stack, which is accessed from the roof; and (4) the temporary Towel Wash Room exhaust stack, which is accessed from the ground near the loading dock. EPA Method 2 traverse points were selected according to EPA Method 1 and 1A. EPA Method 25A and TO-15 samples were collected from a point near the duct centers. Figure 4-1 contains a schematic diagram of the stacks and sampling ports.

The primary source of ventilation air entered the Towel Wash Room enclosure through a partially open door (natural draft opening-NDO) near the end of the building opposite to the location of the temporary fan. The enclosure was designed to draw outside air from the clean product room, across the sources in the main operations room, and out through a personnel door located adjacent to the loading dock at the back of the building. Figure 4-1 shows the locations of the ventilation air intake and exhaust points. Note that the dryer uses outside air drawn from an intake vent on the roof. Therefore, the dryer operation did not affect the Towel Wash Room enclosure air flow. The enclosure capture efficiency was monitored hourly using room static pressure measurements (static pressure must be less than 0.007 in. Hg) and NDO face velocity measurement (velocity must be greater than 200 fpm).

Modifications were made to the Towel Wash Room enclosure during the processing of print towels to improve air flow through the Towel Wash Room. These modifications included opening additional NDOs in the Towel Wash Room that included the large roll up door next to the Sorting Station and another roll up door and doorway near the corner of the Towel Wash Room.



NOT-TO-SCALE

TRC
21 Griffin Rd. North
Windsor, CT 06095
(860) 298-9692

FIGURE 4-1
EMISSIONS TEST AIR FLOW SCHEMATIC

Date: 09/12 | **Project No.** 193461

5.0 SAMPLING AND ANALYTICAL PROCEDURES

5.1 EPA Methods 1, 2, 3, and 4 – Gas Flow Rate

Gas flow rate, O2/CO2 content, and moisture concentration were measured in accordance with EPA Methods 1, 2, 3A, and 4 at the combustion source vents (dryer stack). Gas flow rate and moisture concentration were measured at the non-combustion source vents (temporary Ellis Washer system vents and temporary Towel Wash Room vent) in accordance with EPA Methods 1 and 2 and wet bulb/dry bulb temperature measurements.

Velocity traverses were conducted with a calibrated S-type pitot assembly in accordance with EPA Reference Methods 1 and 2. An S-type pitot tube and inclined manometer were used to measure gas velocity at multiple points selected in accordance with EPA Method 1 and a calibrated Type-K thermocouple and digital meter were used to measure the flue gas temperature.

A cyclonic flow check was conducted in accordance with EPA Method 1 using the nulling technique. An S-type pitot tube connected to an inclined manometer was used in this method. The pitot tube was positioned at each traverse point so that the face openings of the pitot tube were perpendicular to the stack cross-sectional plane. This position is called the "0° reference". The velocity pressure (ΔP) measurement was noted. If the ΔP reading was not zero, the pitot tube was rotated clockwise or counter clockwise until the ΔP reading became zero. This angle was then measured with a leveled protractor and reported to the nearest degree. The average of the absolute value of the cyclonic angles was calculated and must be less than 20 degrees.

Concentrations of O_2 and CO_2 were continuously monitored at the Dryer Stack in accordance with EPA Method 3A. Method 3A measurements were not conducted on the temporary Towel Wash Room and Ellis Washer exhaust stacks as the composition there is 20.9% O_2.

Dryer stack moisture concentrations were measured periodically in accordance with EPA Method 4. Sample gas was pumped through a stainless steel probe, a Teflon sample line, a series of chilled impingers, and a dry gas meter. Sample gas moisture was condensed in the impingers and the condensate was quantified gravimetrically. The gas moisture content was calculated as a function of water collected in the impingers and volume of gas sampled. The Method 4 sampling train is shown in Figure 5-1. Method 4 tests were conducted on the dryer stack concurrently with each emissions test.

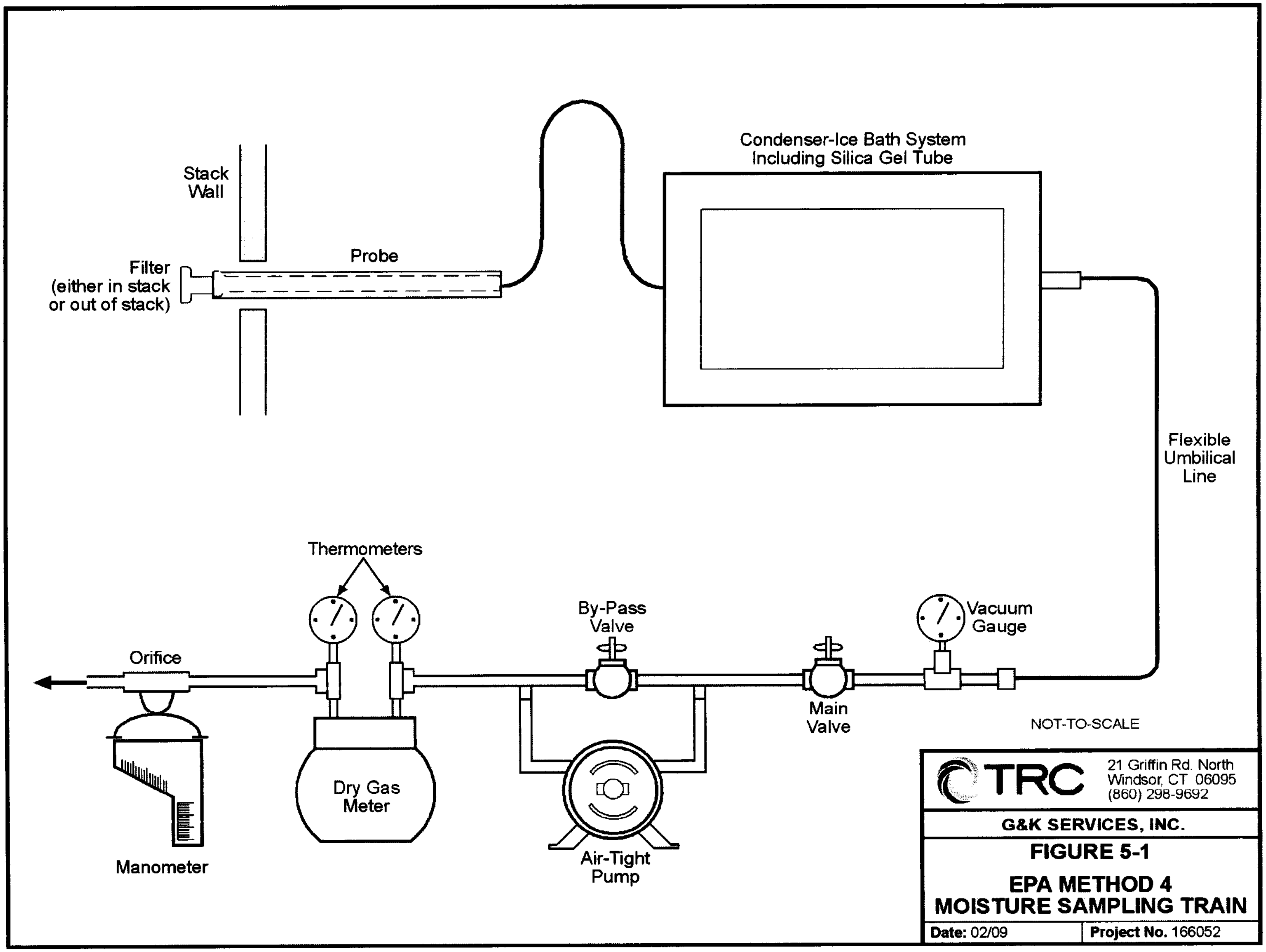


FIGURE 5-1

EPA METHOD 4
MOISTURE SAMPLING TRAIN

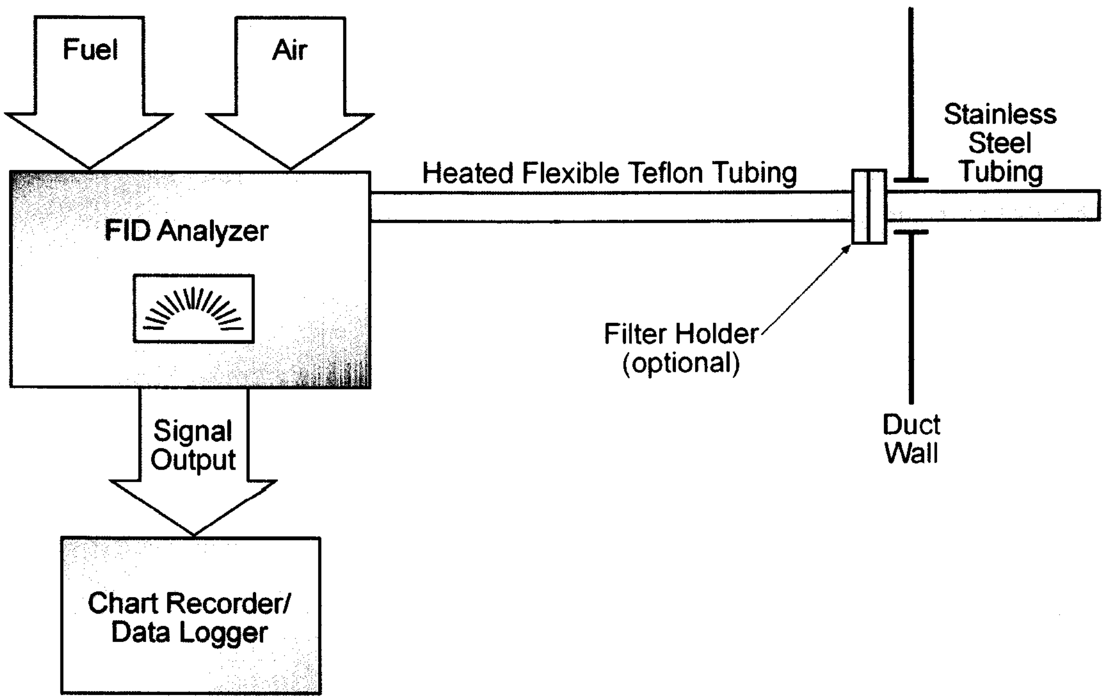
The Towel Wash Room and Ellis Washer temporary vents moisture concentrations were determined with wet bulb/dry bulb temperature measurements. Temperature measurements were conducted concurrently with each EPA Method 1 and 2 gas flow rate test.

5.2 EPA Method 25A – Total Hydrocarbon Continuous Monitoring

Total hydrocarbons were continuously monitored at the dryer stack, the temporary Towel Wash Room exhaust stack, and the temporary Ellis Washer stacks in accordance with EPA Method 25A.

5.2.1 Sample Collection

Each sampling train consisted of a stainless steel probe, heated Teflon sample line, and a California Analytical Instruments, Inc. Model 300 heated FID total hydrocarbon analyzer (California Model 300 FID). A schematic of this sampling system is presented in Figure 5-2. The California Model 300 FID is a heated hydrocarbon analyzer, which detects concentrations of VOC in a sample stream by burning them in a hydrogen flame ionizes VOC in the gas stream. The burner tip is positioned between two highly charged (approximately 300 VDC) plates. Ions are produced from the combustion of the VOC in the gas stream and create a current through migration of the ions between the highly charged plates. The current created is directly proportional to the concentration of hydrocarbons present in the gas stream. A computer-based data acquisition system was used to record data. The data acquisition system was programmed to record 1-minute averages. Calibrations (zero and span) were performed using certified methane in air calibration gases at the beginning and end of each test period. Multi-point calibrations (zero, mid and span) were performed prior to the start of each test day to demonstrate linearity. The Towel Room Air analyzer was operated on a 0-1000 ppm as methane range and the two Ellis Washers and the Dryer analyzers were operated on the 0-10,000 ppm as methane range. The high ranges allowed for VOC spikes at all locations to be captured. A calibration gas table is presented below.



NOT-TO-SCALE

TRC
21 Griffin Rd. North
Windsor, CT 06095
(860) 298-9692

G&K SERVICES, INC.

FIGURE 5-2

FLAME IONIZATION DETECTION
SAMPLING SYSTEM
EPA METHOD 25A

Date: 08/12	**Project No.** 193461

Sampling location	Range	Zero	Low point	Mid point	Span
Dryer	0-10,000 ppm	Hydrocarbon free air	2922 ppm	4940 ppm	8936 ppm
Ellis Washer Temporary Exhausts	0-10,000 ppm	Hydrocarbon free air	2922 ppm	4940 ppm	8936 ppm
Towel Wash Room Temporary Exhaust	0-1000 ppm	Hydrocarbon free air	250.9 ppm	450.2 ppm	892.0 ppm

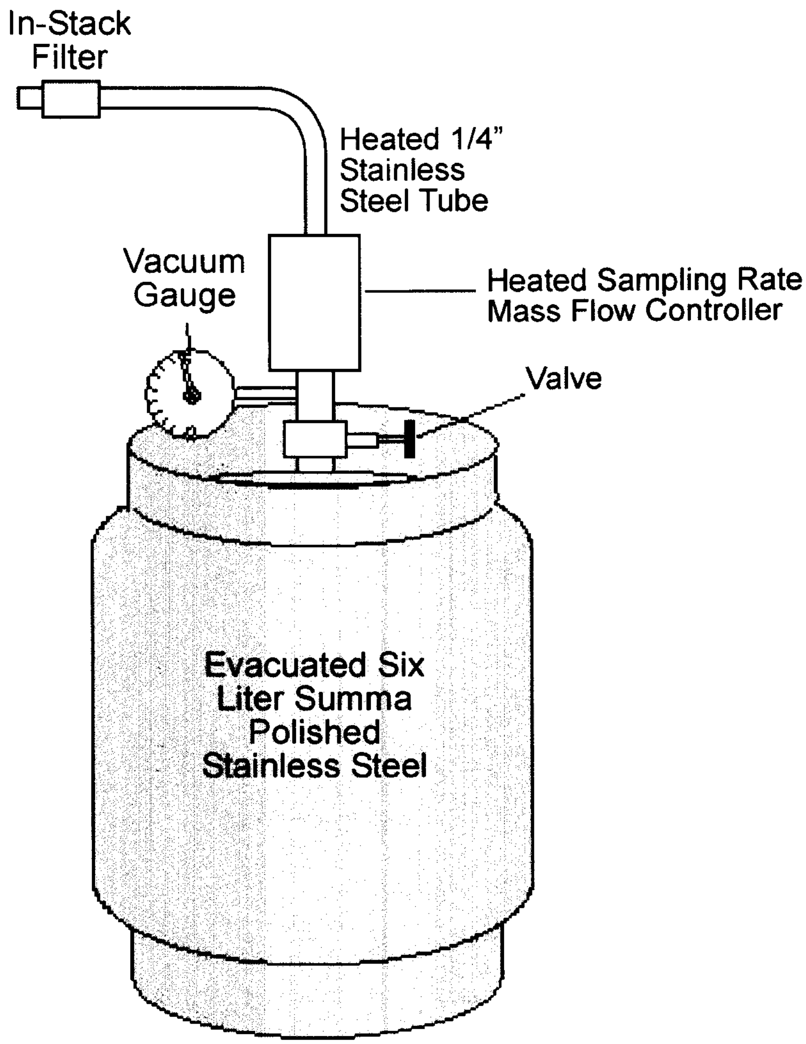
5.3 EPA Method TO-15 – HAP Emission Concentration

HAP emission concentrations were measured at the dryer stack, the temporary Ellis Washer exhausts and the temporary wash room exhaust in accordance with EPA Method TO-15. Samples were collected in 6 liter passivated stainless steel canisters. The sampling system consisted of a stainless steel probe, mass flow controller, vacuum gauge, valve, and canister. The sampling system is shown in Figure 5-3. The canisters were evacuated to an absolute pressure of less than 0.5 in Hg prior to sampling. The mass flow controller is a diaphragm-type where the diaphragm increases the opening as the differential pressure decreases to maintain a constant sampling rate. The canister pressure was checked and recorded at the beginning and end of each sampling period.

The TO-15 sampling procedure was modified on the dryer stack to eliminate moisture condensation and the potential loss of water soluble organics. The stainless steel probe, flow controller, and valve were heated to approximately 120°F to prevent condensation prior to the canister. In addition, a mini-impinger containing de-ionized water was placed immediately before the collection canister to remove any moisture from the sample stream. Both the contents of the impinger and the canister were analyzed for HAPs.

The TO-15 samples at the temporary Ellis Washer exhausts and the Towel Wash Room exhaust were operated without the heated components. The sampling duration will be approximately 4-6 hours for the Ellis washer exhausts and 8 hours for the wash room exhaust. A total sample volume of approximately 4.8 liters was collected.

Figure 5-3 EPA Method TO-15 Sampling Train Schematic



NOT-TO-SCALE

TRC	21 Griffin Rd. North Windsor, CT 06095 (860) 298-9692
G&K SERVICES, INC.	
FIGURE 5-3 EPA METHOD T0-15 SAMPLING TRAIN SCHEMATIC	
Date: 08/12	Project No. 193461

Analysis was conducted with temperature-programmed gas chromatography/low-resolution mass spectrometry by Columbia Analytical, Inc. The concentrations of HAPs were calculated using the internal standard technique. The samples were analyzed for the target compounds presented in Table 5-1. In addition, the impinge contents from the TO-15 samples collected at the dryer exhaust were analyzed by EPA Method 8260 for target compounds presented in Table 5-2.

5.4 EPA Method 204 – Towel Wash Room Enclosure Design and Capture Efficiency Determination

The temporary Towel Wash Room exhaust fan was designed for 10,000 cfm at a static pressure of 2.0 inches w.c. The total volume of the laundry room and adjacent clean product room is 138,000 cubic feet. The temporary fan was located at a personnel door near the loading dock at the east side of the building. The enclosure had a single natural draft opening ("NDO") during both of the shop towel test days which was located at the personnel door on the south side of the clean product room. The enclosure had multiple NDOS during the print towel test day. Exhaust air was sweep through the clean product room, into the laundry room at the product bagging station, through the laundry room and out of the building at the far side of the laundry room. The NDO dimensions were adjusted to yield a building differential pressure of -0.007 inches w.c.

The exhaust fan was equipped with a 24-inch diameter sheet metal pipe connected to the negative side of the fan. The overall length of the pipe was 240 inches. Sampling ports were located 192 inches (8 diameters) downstream and 48 inches (2 diameters) upstream of flow disturbances.

The permanent enclosure capture efficiency was demonstrated in accordance with EPA Method 204. Method 204 criteria include physical dimensions and minimum air velocity at enclosure openings. If the criteria are met, the enclosure capture efficiency is qualified as 100 percent. The building enclosure is shown in Figure 5-4 and the following parameters were verified in the capture efficiency test:

Table 5-1 EPA Method TO-15 Target Compound List

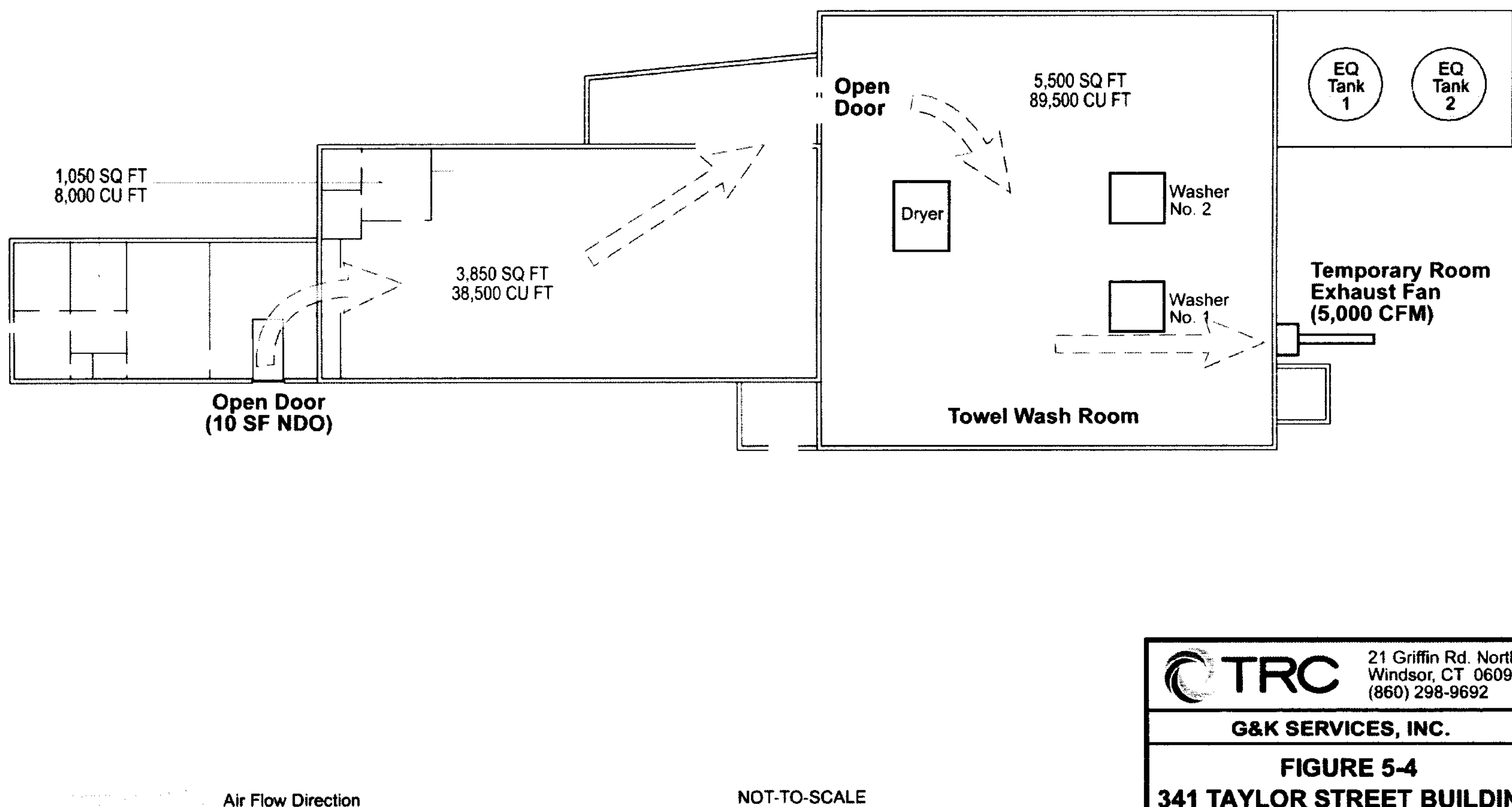
Compound	ppbv MRL
Propene	0.29
Dichlorodifluoromethane (CFC 12)	0.10
Chloromethane	0.24
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	0.072
Vinyl Chloride	0.20
1,3-Butadiene	0.23
Bromomethane	0.13
Chloroethane	0.19
Ethanol	2.7
Acetonitrile	0.30
Acrolein	0.22
Acetone	2.1
Trichlorofluoromethane	0.089
2-Propanol (Isopropyl Alcohol)	0.20
Acrylonitrile	0.23
1,1-Dichloroethene	0.13
Methylene Chloride	0.14
3-Chloro-1-propene (Allyl Chloride)	0.16
Trichlorotrifluoroethane	0.065
Carbon Disulfide	0.16
trans-1,2-Dichloroethene	0.13
1,1-Dichloroethane	0.12
Methyl tert-Butyl Ether	0.14
Vinyl Acetate	1.4
2-Butanone (MEK)	0.17
cis-1,2-Dichloroethene	0.13
Ethyl Acetate	0.14
n-Hexane	0.14
Chloroform	0.10
Tetrahydrofuran (THF)	0.17
1,2-Dichloroethane	0.12
1,1,1-Trichloroethane	0.092
Benzene	0.16
Carbon Tetrachloride	0.080
Cyclohexane	0.15
1,2-Dichloropropane	0.11
Bromodichloromethane	0.075

Compound	ppbv MRL
Trichloroethene	0.093
1,4-Dioxane	0.14
Methyl Methacrylate	0.12
n-Heptane	0.12
cis-1,3-Dichloropropene	0.11
4-Methyl-2-pentanone	0.12
trans-1,3-Dichloropropene	0.11
1,1,2-Trichloroethane	0.092
Toluene	0.13
2-Hexanone	0.12
Dibromochloromethane	0.059
1,2-Dibromoethane	0.065
n-Butyl Acetate	0.11
n-Octane	0.11
Tetrachloroethene	0.074
Chlorobenzene	0.11
Ethylbenzene	0.12
m,p-Xylenes	0.23
Bromoform	0.048
Styrene	0.12
o-Xylene	0.12
n-Nonane	0.095
1,1,2,2-Tetrachloroethane	0.073
Cumene	0.10
alpha-Pinene	0.090
n-Propylbenzene	0.10
4-Ethyltoluene	0.10
1,3,5-Trimethylbenzene	0.10
1,2,4-Trimethylbenzene	0.10
Benzyl Chloride	0.097
1,3-Dichlorobenzene	0.083
1,4-Dichlorobenzene	0.083
1,2-Dichlorobenzene	0.083
d-Limonene	0.090
1,2-Dibromo-3-chloropropane	0.052
1,2,4-Trichlorobenzene	0.067
Naphthalene	0.095
Hexachlorobutadiene	0.047

Table 5-2 EPA Method 8260 Target Compound List (Impinger Analysis)

Compound	ug/L MRL
Dichlorodifluoromethane (CFC 12)	2.5
Chloromethane	2.5
Vinyl Chloride	2.5
Bromomethane	2.5
Chloroethane	2.5
Trichlorofluoromethane	2.5
1,1-Dichloroethene	2.5
Acetone	100
Carbon Disulfide	2.5
Methylene Chloride	10
trans-1,2-Dichloroethene	2.5
1,1-Dichloroethane	2.5
2,2-Dichloropropane	2.5
cis-1,2-Dichloroethene	2.5
2-Butanone (MEK)	100
Bromochloromethane	2.5
Chloroform	2.5
1,1,1-Trichloroethane	2.5
Carbon Tetrachloride	2.5
1,1-Dichloropropene	2.5
Benzene	2.5
1,2-Dichloroethane	2.5
Trichloroethene	2.5
1,2-Dichloropropane	2.5
Dibromomethane	2.5
Bromodichloromethane	2.5
cis-1,3-Dichloropropene	2.5
4-Methyl-2-Pentanone (MIBK)	100
Toluene	2.5
trans-1,3-Dichloropropene	2.5
1,1,2-Trichloroethane	2.5
Tetrachloroethene (PCE)	2.5

Compound	ug/L MRL
2-Hexanone	100
1,3-Dichloropropane	2.5
Dibromochloromethane	2.5
1,2-Dibromoethane (EDB)	10
Chlorobenzene	2.5
Ethylbenzene	2.5
1,1,1,2-Tetrachloroethane	2.5
m,p-Xylenes	2.5
o-Xylene	2.5
Styrene	2.5
Bromoform	2.5
Isopropylbenzene	10
1,1,2,2-Tetrachloroethane	2.5
Bromobenzene	10
n-Propylbenzene	10
1,2,3-Trichloropropane	2.5
2-Chlorotoluene	10
1,3,5-Trimethylbenzene	10
4-Chlorotoluene	10
tert-Butylbenzene	10
1,2,4-Trimethylbenzene	10
sec-Butylbenzene	10
4-Isopropyltoluene	10
1,3-Dichlorobenzene	2.5
1,4-Dichlorobenzene	2.5
n-Butylbenzene	10
1,2-Dichlorobenzene	2.5
1,2-Dibromo-3-chloropropane	10
1,2,4-Trichlorobenzene	10
Hexachlorobutadiene	10
Naphthalene	10
1,2,3-Trichlorobenzene	10



TRC
21 Griffin Rd. North
Windsor, CT 06095
(860) 298-9692

G&K SERVICES, INC.

FIGURE 5-4
341 TAYLOR STREET BUILDING ENCLOSURE SCHEMATIC

Date: 08/12 | **Project No.** 193461

1. Any NDO shall be at least 4 equivalent opening diameters from the VOC emitting point. Equivalent diameter for rectangular openings is calculated as follows: $D_e = 2(L)(W) \div (L+W)$.

2. Any exhaust point from the enclosure shall be at least four equivalent diameters from each NDO.

3. The total area of all NDOs shall not exceed 5 percent of the surface area of the enclosure walls, floor and ceiling.

4. The average face velocity at all enclosure NDOs will be at least 200 fpm and the direction of the airflow will be into the enclosure. Alternatively, the pressure drop across the enclosure shall be greater than 0.007 inches w.c.

5. All access doors, windows and hood latches which are not identified as NDOs shall be closed during normal operation.

5.5 EPA Method 204 – Ellis Washer Enclosure Design and Capture Efficiency Determination

The Ellis Washer system vents were enclosed with separate temporary total enclosures. The enclosures were equipped with fans designed for 300 cfm at a static pressure of 0.05 inches w.c. Each enclosure had four natural draft openings ("NDO") which were located on the sides of the enclosures. Exhaust air swept through the enclosures into a 6 inch diameter exhaust duct to allow for measurement of flow rate and collection of HAP and VOC samples. Sampling ports were located 48 inches (8 diameters) downstream and 12 inches (2 diameters) upstream of flow disturbances. A diagram of the temporary enclosure for the Ellis Washer vent is shown in Figure 5-5.

The enclosure capture efficiency was demonstrated in accordance with EPA Method 204. Method 204 criteria include physical dimensions and minimum air velocity at enclosure openings. If the criteria are met, the enclosure capture efficiency is qualified as 100 percent. The following parameters were verified in the capture efficiency test:

1. Any NDO shall be at least 4 equivalent opening diameters from the VOC emitting point. Equivalent diameter for rectangular openings is calculated as follows: $D_e = 2(L)(W) \div (L+W)$.

2. Any exhaust point from the enclosure shall be at least four equivalent diameters from each NDO.

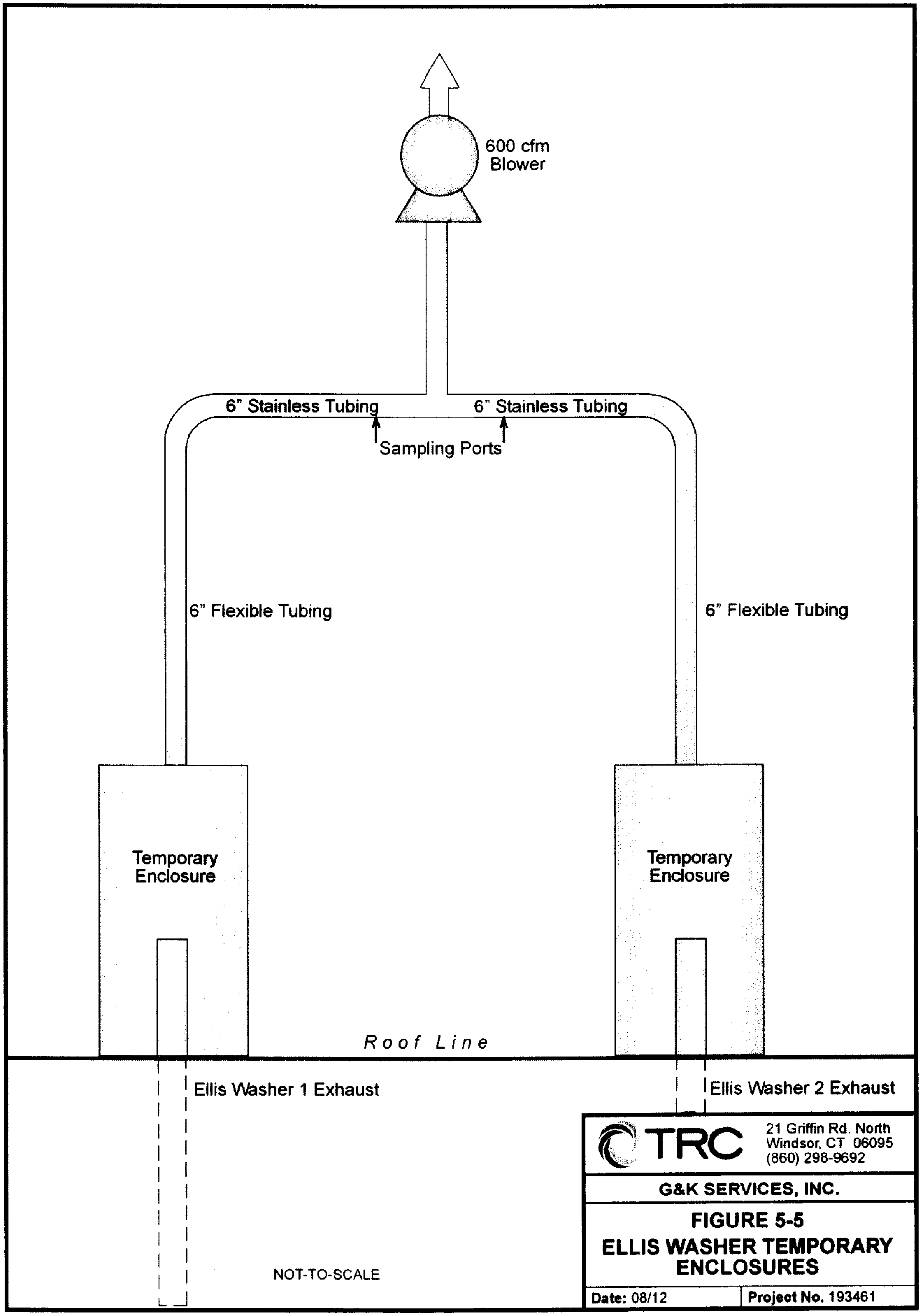


FIGURE 5-5
ELLIS WASHER TEMPORARY ENCLOSURES

3. The total area of all NDOs shall not exceed 5 percent of the surface area of the enclosure walls, floor and ceiling.

4. The average face velocity at all enclosure NDOs will be at least 200 fpm and the direction of the airflow will be into the enclosure. Alternatively, the pressure drop across the enclosure shall be greater than 0.007 inches w.c.

5. All access doors, windows and hood latches which are not identified as NDOs shall be closed during normal operation.

5.6 Process Data

The following process data were recorded during the program.

- daily production (soiled weight)
- water temperature to washers
- water use
- natural gas use
- volume of wastewater discharged
- number and type of washer loads processed
- dry product weight per day

6.0 QA/QC ACTIVITIES

6.1 QC Procedures

TRC's quality assurance program for source emission measurement is designed so that the work is performed by competent, experienced individuals using properly calibrated equipment and approved procedures for sample collection, recovery and analyses with proper documentation. The Program Manager, Project Manager and the Program Quality Assurance Manager were responsible for developing data of the highest quality. The Program Quality Assurance Manager was responsible for performing the accuracy and precision evaluations and the quality control reporting. Specific details of TRC's quality assurance program may be found in EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III (EPA-600/4-94-0271b).

Sampling and measurement equipment, including continuous analyzers, recorders, pitot tubes, dry meters, orifice meters, thermocouples, probes, nozzles, and any other pertinent apparatus, are uniquely identified, undergo preventive maintenance, and are calibrated before and after each field effort following written procedures and acceptance criteria. Calibrations were performed with standards traceable to the National Institute for Science and Technology ("NIST"). These standards include wet test meters, standard pitot tubes, and NIST Standard Reference Materials. Records of all calibration data are maintained in TRC's files. Copies of calibration data pertinent to this program are presented in Appendix K.

During field tests, sampling performance and progress were continually evaluated, and deviations from sampling method criteria were reported to the Field Team Leader who then determined the validity of the test run. All field data were recorded on prepared data sheets. Field Team Leaders maintained a written log describing the events of each day. Field samples, including field blanks, were transported from the field in shockproof, secure containers. Sample integrity was controlled through the use of prepared data sheets, positive sample identification, and chain-of-custody forms.

All calculations were performed using Excel spreadsheets developed by TRC. Final results were checked by a senior-level project engineer. The following discussions present the TRC quality control procedures for each of the proposed test methods.

6.1.1 EPA Methods 2, 3 and 4

The Method 4 sampling train was leak checked before and after each test run and the acceptance criteria was a leak rate of less than 0.02 cfm. The minimum Method 4 sample volume was 21 dscf. During sampling, all pertinent test data were recorded on prepared data sheets. The Method 4 dry gas meters were calibrated annually at multiple flow rates and after each field use at a single flow rate using the EPA Method 5 calibrated orifice procedure. Impinger trains were weighed before and after each test with a calibrated electronic balance.

Method 2 pitot tubes and thermocouples were calibrated prior to field use and inspected after the tests were completed. Pitot tube leak checks were conducted at the conclusion of each test.

6.1.2 EPA Method TO-15

EPA Method TO-15 sampling trains were cleaned according to the respective methods prior to field use. Field QA includes leak checking prior to sampling. EPA Method TO-15 has specified calibration procedures for the sample analyses that will be followed.

6.2 QA Criteria

Table 6-1 presents the QA criteria for EPA Method TO-15.

Table 6-1 EPA Method TO-15 QA Criteria

	Description	Criteria
TO-15	Initial Calibration for each target compound	<30% RSD
TO-15	Laboratory Blank (Internal standard deviation)	+/- 40%
TO-15	Daily Calibration	+/- 30%

6.3 Data Reduction QA Checks

The Test Coordinator performed an independent check (using a validated computer program) of the calculations with predetermined data before the field test to ensure that the calculations were correct. After field effort completion, the program manager and the final reviewer checked the data entry and final calculations.